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STRUCTURE AND OIL AND GAS RESOURCES OF THE OSAGE RESERVATION, OKLAHOMA

TPS. 24, 25, AND 26 N., RS. 6 AND 7 E.
TPS. 25 AND 26 N., R. 5 E.
T. 26 N., R. 4 E.

BY

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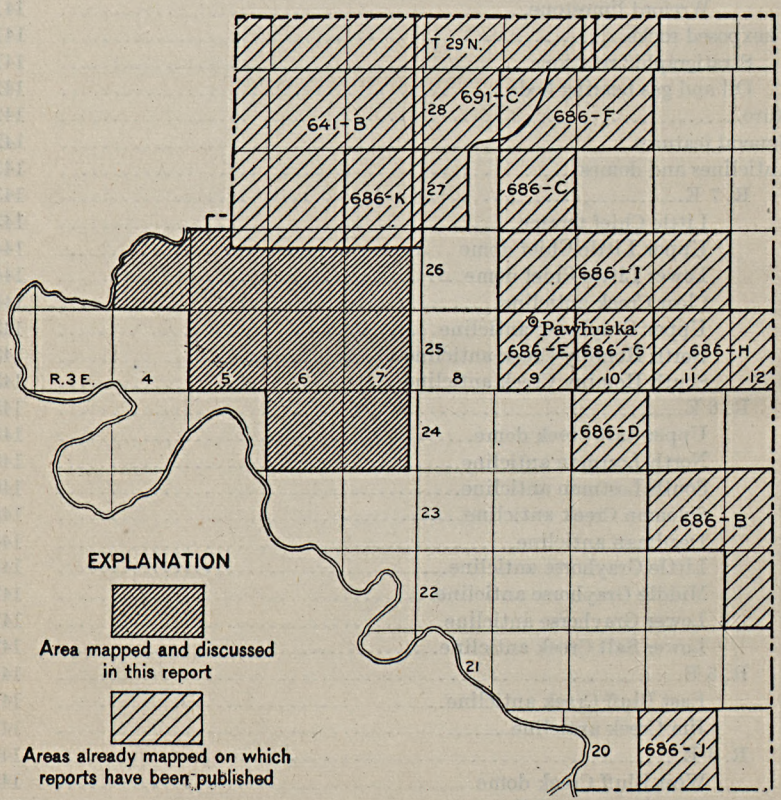


FIGURE 11.—Key map of Osage Reservation showing areas discussed in this and previous bulletins of the United States Geological Survey.

TPS. 24, 25, AND 26 N., RS. 6 AND 7 E.; TPS. 25 AND 26 N., R. 5 E.; T. 26 N., R. 4 E.

By C. F. Bowen.

STRATIGRAPHY.

EXPOSED ROCKS.

GENERAL FEATURES.

The rocks exposed in Tps. 24, 25, and 26 N., Rs. 6 and 7 E.; Tps. 25 and 26 N., R. 5 E.; and T. 26 N., R. 4 E. (see fig. 1), are illustrated graphically in the columnar section on Plate XXII. They have an aggregate thickness of about 1,100 feet and are of upper Pennsylvanian and lower Permian age. They consist of numerous beds of limestone, ranging in thickness from a few inches to 15 feet or more, interstratified with beds of sandstone and shale. The sandstones are thicker and more numerous in the upper and lower portions of the section than in the middle, and many of them are lenticular, wedging out toward the north. Above the Neva limestone all the rocks except the limestones are red; below the Neva more somber colors predominate, though some of the shales have reddish hues. The limestones are of the greatest aid in working out the structure of the region, hence the most prominent and characteristic of them will be described, but no detailed description of the stratigraphy as a whole will be given.

KEY BEDS.

Bird Creek limestone.—The Bird Creek limestone is the lowest one exposed over any considerable part of the area. It is a dense, fine-grained noncrystalline rock about 4 feet thick. On the fresh surface it is commonly lead-gray to black and weathers to a dirty buff or yellow. When struck with the hammer it breaks along bedding planes with comparatively smooth surfaces. It contains fossils of a few species but they are not abundant. It is hard and seems fairly resistant to erosion but does not produce a marked topo-

graphic effect in this area. It was named by Heald[1] from exposures on Bird Creek, in T. 27 N., R. 8 E.

Cryptozoon-bearing limestone.—The *Cryptozoon*-bearing limestone is about 80 feet above the Bird Creek limestone. It is a compact noncrystalline black limestone, overlain in the southern part of the area by a bed which weathers yellow. It is distinguished from the Bird Creek limestone and others which it resembles lithologically by the presence of fossil Cryptozoa and *Fusulina*. In places the Cryptozoa are rather scarce, but they can generally be found by making a careful search, especially if the outcrop of the bed is followed for some distance. As a rule the outcrop of the bed does not produce conspicuous topographic features, and in many places it is concealed by wash, but it is an extremely valuable key bed because of the certainty with which it can generally be recognized.

Stonebreaker limestone.—The Stonebreaker consists of three or more beds of limestone separated by shale and sandstone, the whole having a thickness of 30 to 40 feet. The middle bed of limestone is the most distinctive bed of the division. It is a finely crystalline gray to brownish ferruginous limestone which weathers to a brownish color. In the northern part of the area the upper part of this bed is marked by a layer or discontinuous masses of rock which weathers to a deep limonitic brown and contains Cryptozoa, a few *Fusulina*, and fragments of other fossils. In the southern part of the area the limonitic color is not so constant and may appear at other horizons than the top of the bed; the Cryptozoa decrease in number and prominence and the *Fusulina* greatly increase, so that they become the most characteristic fossils.

The upper bed of limestone is a gray to drab crystalline rock, 4 or 5 feet thick, containing an abundance of comminuted fossil remains and in the southern part of the area some small *Fusulina*. It is distinguished from the middle bed by the absence of Cryptozoa, the smaller size of the contained *Fusulina*, and the general absence of limonitic color, through locally it is strongly limonitized. The sandstones above the Stonebreaker as a rule form rather prominent ridges or scarps, which constitute a valuable guide in following the limestones.

Grayhorse limestone.—The Grayhorse limestone is named from its excellent exposure on the crest of the Little Grayhorse anticline, in the NW. ¼ sec. 11, T. 24 N., R. 6 E. It is also well exhibited in the high point in the NE. ¼ sec. 33, T. 26 N., R. 7 E., in the upper part of the drainage basin of Clear Creek, and is one of the most distinctive key rocks in the area herein described. It is a dark brownish-gray crystalline conglomeratic limestone, commonly about 2 feet

[1] Heald, K. C., report on T. 27 N., R. 8 E., in preparation to form a part of Bulletin 686.

thick but locally as much as 4 feet thick. It contains numerous small pebbles ranging in size from mere grains to pebbles as large as a large pea, which weather to a dirty-white color and give the weathered surface of the rock a mottled appearance. In most places it also contains numerous large fossils of the species *Myalina subquadrata*, some of which are 3 or 4 inches in their longest dimension. Where it crops out on steep slopes the bed breaks off in large slabs, as much as 10 feet across, which strew the slope below. The bed is so distinctive that after having once been identified it is generally recognized without difficulty, and it is therefore a valuable key bed.

Foraker limestone.—The Foraker limestone comprises several beds of limestone interstratified with shale and some sandstone, having an aggregate thickness of about 100 feet. The limestones are characterized by an abundance of *Fusulina* throughout and few other distinguishable fossils. For convenience of description the formation may be separated into three divisions.

The lower division consists of two thin limestones overlain by 45 feet of shale and sandstone, the beds of which increase in number and thickness toward the south. Because of their thinness and lithologic uniformity the limestones at the base of this division constitute valuable key beds. The lower bed is about 2 feet thick, has a gray color when fresh, weathers to yellow or light brown, and in addition to *Fusulina* contains locally brachiopods, *Myalina*, and other fossils. The upper of these two beds is separated from the lower by 5 to 8 feet of shale. The limestone is about 1 foot thick, is dense and fine grained, has a dark-gray to black color, and contains small *Fusulina*. These beds are resistant to erosion and are commonly well exposed, notwithstanding the fact that they crop out at the base of a steep slope.

The middle division of the Foraker consists of a limestone about 2 to 5 feet thick overlain by 15 feet of shale. The lower part of the limestone is dense, fine grained, and black and contains medium-sized *Fusulina* which exhibit a pale flesh color on a freshly broken surface. Overlying this is a somewhat limonitic bed that weathers yellow or light brown. In the southern part of the area this limestone is directly overlain by a sandstone which thins toward the north and west and is absent or very thin in T. 26 N.

The upper division consists of three or more limestones separated by thin beds of shale. The limestones are gray to white, and those at the top weather light yellow in the southern part of the area. They are all thickly crowded with large *Fusulina*. In T. 26 N. one of the limestone beds about the middle of this upper division contains a large amount of chert nodules which on the fresh surface exhibit a pale blue color and are inset with numerous large white *Fusulina*. This chert is almost entirely absent south of the boundary between

Tps. 25 and 26 N. The limestones of this upper division produce a broad sloping surface which terminates on the east in a sharp rim or scarp.

Red Eagle limestone.—The Red Eagle limestone is a gray crystalline limestone ranging from 12 to 25 feet in thickness. In some places parts of the bed are slightly limonitic and weather yellow. Where thickest the Red Eagle consists of several beds of limestone separated by beds of shale. In other places the shale seems to be absent. In such places only the upper part of the bed is commonly exposed, but its entire thickness seems to be about 10 or 12 feet. The limestone contains few if any fossils and because of its changeable thickness is not a good key bed.

Neva limestone.—The Neva limestone as here identified comprises four thin beds of limestone separated by beds of gray shale. A compiled section measured in the vicinity of Burbank is as follows:

Section of Neva limestone near Burbank.

	Feet.
Limestone, gray, somewhat cherty, soluble; chert commonly lying loose on the surface	2
Shale	6±
Limestone, gray, containing large nodules of chert; both chert and limestone full of large *Fusulina*. Chert nodules white on freshly broken surface; weather brown with a sandy appearance. These nodules strew the surface so thickly that wheeling over them is difficult	2
Shale	8
Limestone, gray; weathers white; contains no fossils or chert; weathers into large, thin, sharp-edged slabs; forms prominent rim	4
Shale	12
Limestone, dense, noncrystalline; has straw-yellow color streaked with maroon; contains pelecypods; rarely well exposed	2½
	36½

Cottonwood limestone.—The Cottonwood lies about 80 feet above the Neva and is a light-gray to white crystalline limestone. The lower part is slightly conglomeratic or oolitic in some places, but this feature does not seem to be constant. In some places *Fusulina* occur in the upper part of the bed and gastropods and other fossils in the lower part. The bed is 4½ feet thick in a cut on the Atchison, Topeka & Santa Fe Railway in sec. 9, T. 26 N., R. 5 E.

Crouse limestone.—The Crouse limestone is about 130 feet above the Cottonwood. In its most common aspect it is a light-gray thin-bedded, ledge-making limestone, 6 to 13 feet thick. Large massive buff blocks as much as 12 or 15 feet in length and comprising the entire thickness of the bed replace the bedded mass at short intervals along the outcrop. The limestone is very porous, both in vertical

faces and in its flat upper surface, where large cylindrical holes, vertical or nearly so, are very numerous. In some places a bed near the top is literally filled with small Foraminifera. Here and there also the lower 2 or 3 feet of the bed is finely and abundantly conglomeratic, but this feature is not common.

Wreford limestone.—The term Wreford is here applied to two limestones separated by about 20 feet of sandstone and shale, lying about 92 feet above the Crouse. The upper limestone may belong to the Fort Riley, but not enough work has yet been done by the writer to determine this point. The lower limestone is a bedded limestone about 8 or 10 feet thick, of which only the upper 4 or 5 feet is commonly exposed. At the base it is light brown; above the basal part it is gray with a slight buff tinge, weathers into large slabs, and forms broad sloping terraces that terminate along drainage lines or along its eastern front in a high ledge or scarp. The upper limestone consists of a lower yellow fossiliferous bed about 2 feet thick, overlain by a bed of cellular light-gray crystalline rock. One peculiar feature in this area is that no chert was seen associated with either of the limestone beds referred to the Wreford, although chert is characteristic of it in all other localities where it has been studied.

UNEXPOSED ROCKS.

STRATIGRAPHIC RELATIONS.

The rocks not exposed at the surface which have been penetrated by the drill in or adjacent to the western part of the Osage Reservation are shown in Plate XXI. Of the five well records shown, only one of them represents a well drilled within the area under consideration. The relation of the productive sands and of the "Oswego lime" and "Mississippi lime" to the key beds of the exposed rocks, as indicated by a comparison of the well logs and the columnar section of exposed rocks, is shown in tabular form below. The figures given are of course only approximations, based on the assumption that the intervals between the beds remain constant.

Intervals, estimated to nearest .50 feet, between key beds at surface and important beds not exposed.

Key bed.	Layton sand.	Cleveland sand.	"Oswego lime."	"Mississippi lime."
Base of Wreford limestone	2,500	2,650–2,800	3,000	3,600
Crouse limestone	2,400	2,550–2,700	2,900	3,500
Cottonwood limestone	2,250	2,400–2,550	2,750	3,350
Base of Neva limestone	2,150	2,300–2,450	2,650	3,250
Red Eagle limestone	2,100	2,350–2,400	2,600	3,200
Base of Foraker limestone	1,950	2,100–2,250	2,450	3,050
Grayhorse limestone	1,850	2,000–2,150	2,350	2,950
Top of Stonebreaker limestone	1,700	1,850–2,000	2,200	2,800
Cryptozoon-bearing limestone	1,600	1,750–1,900	2,100	2,700
Bird Creek limestone	1,500	1,650–1,800	2,000	2,600

This table gives an idea of the depth at which the productive sands of the Cleveland pool, to the southeast, and of deeper sands in other productive fields in Oklahoma should be reached in any particular part of the area discussed. This statement assumes, of course, that these sands extend across the "western Osage," an assumption which has not been verified but which seems to be borne out by the well records in adjacent territory on the east, south, and west.

OIL AND GAS BEARING BEDS.

In the Cleveland pool, in T. 21 N., R. 8 E., oil is found in the Layton, Cleveland, Bartlesville, and Tucker sands. The Bartlesville lies at a depth of 575 to 675 feet below the Cleveland, and the Tucker at 200 to 300 feet below the Bartlesville. In the Pawhuska quadrangle, in the eastern part of Osage County, oil and gas are obtained at two or more horizons in the "Mississippi lime," also in the Bartlesville (here including the Tucker sand), the "Oswego lime," sands between the "Oswego" and Big limes, the Big lime, and a sand about 100 feet above the Big lime. It is reasonably certain that some of these sands underlie the "western Osage," and the inference is warranted that oil and gas will be found in them where structural and other conditions favor accumulation. The Ponca City field obtains its oil and gas from shallow sands, most of which are exposed in the "western Osage." The probable relation of these sands to the key beds described in this report is shown in columns 6 and 7 of Plate XXI. It is probable that some of these shallow sands also contain oil and gas in the western part of the Osage Reservation in areas sufficiently removed from the outcrop of the sands.

STRUCTURE.

GENERAL FEATURES.

The rocks in the area described show an average westward dip of about 35 feet to the mile, or a little less than half a degree. The westward dip is more constant here than in the eastern part of the Osage Reservation, and there are fewer deviations from the general regional structure and consequently fewer anticlines and domes.

Because of this regional westward dip, the rocks that form the surface are successively younger and higher stratigraphically toward the west. For this reason the rocks that appear at the surface in the "western Osage" have been eroded from most of the Pawhuska quadrangle and areas farther east, and conversely the surface rocks in those areas lie below the surface of the "western Osage" and are not open to inspection. The convergences which are known to occur between these lower rocks in the Pawhuska quadrangle therefore can not be taken into account in the western region, and the

1
Log of Margaret Primeux well No. 7
Sec. 4, T. 25 N., R. 2 E.

2
Log of well 1 mile northwest of Ralston
NE.¼ SE.¼ sec. 34, T. 24 N., R. 5 E.

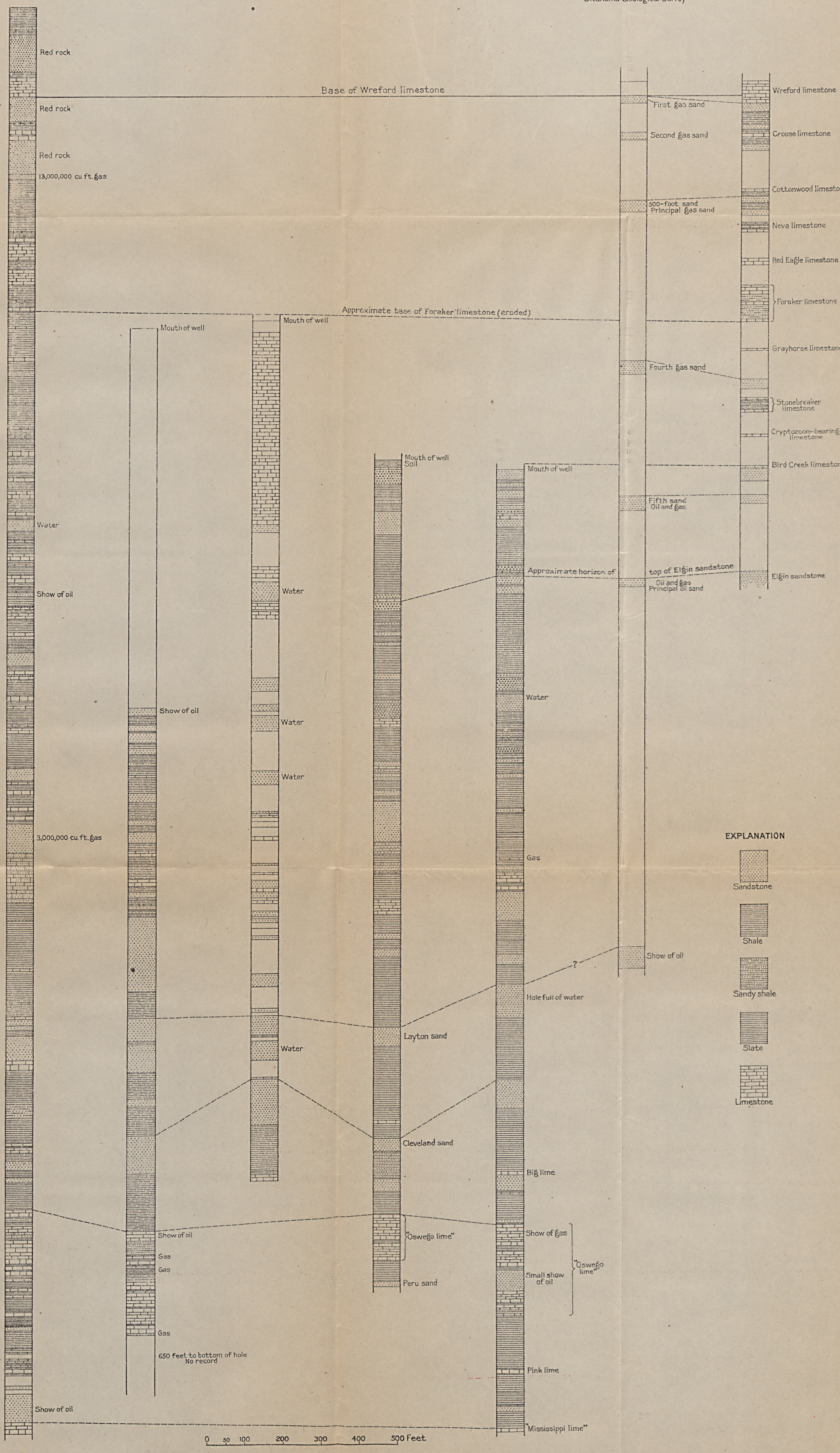
3
Log of well about 2 miles northeast of Fairfax
SW.¼ sec. 5, T. 24 N., R. 6 E.

4
Log of Monitor Oil Co. well No. 1
Sec. 25, T. 22 N., R. 7 E.

5
Log of Pawhuska Oil & Gas Co. well No. 26
SE.¼ SE.¼ sec. 6, T. 24 N., R. 8 E.

6
Skeleton section showing oil and gas sands at Ponca City from Bulletin 16, Oklahoma Geological Survey

7
Skeleton section of exposed rocks



SECTIONS SHOWING DRILLER'S INTERPRETATIONS OF UNEXPOSED ROCKS IN OR ADJACENT TO WESTERN OSAGE COUNTY, THEIR RELATIONS TO THE EXPOSED ROCKS, AND THE PROBABLE CORRELATIONS OF THE SANDS

higher the position of the surface beds in the geologic column the more widely may they depart from parallelism with the rocks below, especially those which, like the "Oswego lime" and "Mississippi lime," lie at depths of ranging between 2,000 and 3,600 feet. This feature precludes the possibility of matching structure contours that are drawn on widely separated reference horizons. Some discrepancy appears in the contours drawn along the common margin between the area herein described and the Pawhuska quadrangle or "eastern Osage." This same lack of parallelism between beds also makes difficult the correlation of beds encountered in drilling over wide areas. The correlations shown on Plate XXI are therefore suggestive and tentative rather than conclusive, but they are based on a careful study of the columnar sections of rocks exposed in both the western and eastern Osage and a comparison of these sections with the legs of wells whose approximate surface horizons are known.

The correlation of the Ponca City sands with the stratigraphic section of the western part of the Osage Reservation, as shown in Plate XXI, is slightly different from that suggested by Ohern and Garrett.[1] The correlation here given indicates that the 500-foot sand of the Ponca City field is probably equivalent to one of the sands associated with the Cottonwood limestone; that the "fourth sand" is probably equivalent to the sandstone above the Stonebreaker limestone which crops out about 4 to 6 miles west of Fairfax; and that the lowest productive sand is at approximately the same position as the Elgin sandstone. On this basis the deep sand in the well on the 101 ranch, in the Ponca City field, is probably the equivalent of the Layton instead of the Cleveland sand of the Cleveland field.

The structure contours shown on Plates XXII and XXIII are drawn on the Bird Creek limestone. In the following pages anticlines and domes are described by ranges from east to west.

ANTICLINES AND DOMES.

R. 7 E.

Little Chief terrace.—The Little Chief terrace occupies most of sec. 16, T. 26 N., R. 7 E. Its upper surface is about three-quarters of a mile wide and slopes very gently to the west. East of the flat or terrace the westward dip amounts to about 40 feet in the first mile and a half; on the west the rocks dip about 35 feet in the first half mile. The base of the Foraker limestone crops out in a north-south direction across the surface of the terrace, and along this line of outcrop the depths to the "Oswego lime" and the "Mississippi lime" are estimated to be 2,450 feet and 2,950 to 3,050 feet, respectively. Terraces of this character are commonly considered less favorable

[1] Ohern, D. W., and Garrett, R. E., The Ponca City oil and gas field: Oklahoma Geol. Survey Bull. 16, p. 27, 1912.

for the accumulation of oil and gas than anticlines or domes and are therefore not recommended as places for initial tests in unexplored territory. A large, well-defined terrace may, however, furnish as favorable conditions as an anticlinal "nose" that has no eastward dip or reversal. If the domes near by are found to contain oil and gas, this terrace would offer the next best chance in the immediate vicinity. Probably the best place for a test well on this terrace is part way down the west slope, and therefore the center of the NW. ¼ sec. 16 and a point about 1,500 feet north and 500 feet east from the southwest corner of the section are recommended as favorable places for testing the terrace in the event that oil or gas are found in the more favorable domes near by.

Upper Little Chief dome.—The Upper Little Chief dome occupies parts of secs. 19, 20, 29, and 30, T. 26 N., and covers an area of nearly 2 square miles. It has an east closure of 20 feet over an area of nearly half a square mile. The crest of the dome lies a few hundred feet about due south of the north quarter corner of sec. 29. The dips in all directions are relatively gentle. The surface rock is a thin limestone about 30 feet below the base of the Foraker limestone. The "Oswego lime" is therefore estimated to lie at a depth of about 2,400 feet and the "Mississippi lime" at about 3,000 feet. The outline of the dome is based on elevations on the Foraker limestone and the thin beds below it. There is an extensive gathering ground on the west of the fold.

Lower Little Chief dome.—The Lower Little Chief dome lies mainly in sec. 31, T. 26 N., and sec. 6, T. 25 N., but extends westward into the adjoining sections in R. 6 E. The outline of the dome is based on elevations on the Grayhorse and Foraker limestones and the thin limestones which lie between them. Its crest lies about 1,500 feet east-northeast of the southwest corner of sec. 31, T. 26 N., and it has a closure of about 10 feet. The dip to the north and south is gentle, but that on the west amounts to about 100 feet in the first mile. This dome is small but has an extensive gathering ground. The "Oswego lime" is estimated to lie at a depth of about 2,350 feet below its crest, and the "Mississippi lime" at about 2,800 to 2,950 feet.

Clear Creek anticline.—The Clear Creek anticline extends northwestward through secs. 13, 12, 11, and 10, T. 25 N. It is a low nose with gentle north and south dips but no eastward reversal. Its contouring is based on elevations taken on the *Cryptozoon*-bearing limestone and the several beds of the Stonebreaker limestone. It has an ample gathering ground to the west, north, and south, but its structural value as a possible oil and gas reservoir is questionable. Drilling is not recommended on folds of this type until it is demonstrated that oil or gas occurs in the larger, better-defined domes of

R.4 E.

R.5 E.

T. 26 N.

T. 25 N.

FORAKER QUADRANGLE

ARKANSAS RIVER

Soldani Siding

Burbank

Bluff Creek

WEST BLUFF CREEK ANTICLINE

EAST BLUFF CREEK ANTICLINE

SCHOOLHOUSE ANTICLINE

JIM CREEK ANTICLINE

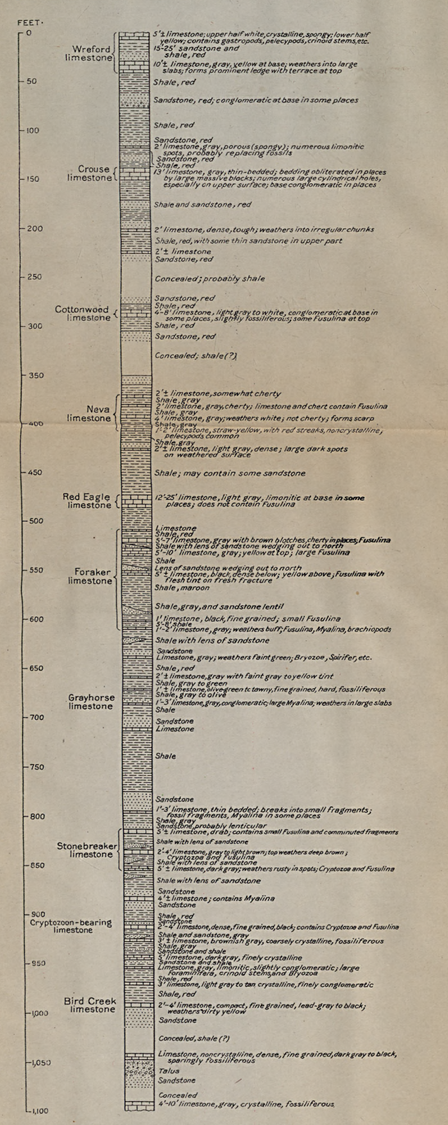
ATCHISON, TOPEKA AND SANTA FE

Charlie Creek

Jim Creek

Salt Creek

No exposures



Columnar section showing rocks exposed in parts of western Osage County

EXPLANATION

Boundary of alluvium

Base of Wreford limestone

Crouse limestone

Cottonwood limestone

Base of Neva limestone

Top of Red Eagle limestone

Base of Foraker limestone

Structure contours
Solid lines, error probably not more than 10 feet.
Dashed lines, error may be more than 10 feet.
Dotted lines, position inferred
Contour interval 10 feet

Scale 1/31,250

1 ½ 0 1 Mile

1918

R.4 E.

R.5 E.

T. 25 N.

T. 26 N.

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MAP SHOWING GEOLOGIC STRUCTURE OF T. 25 N., R. 5 E., AND PARTS OF T. 26 N., RS. 4 AND 5 E., OKLAHOMA

the area. The best place for drilling would be along the crest of the fold, probably well toward its east end or near the northwest corner of sec. 13.

Upper Grayhorse anticline.—The Upper Grayhorse anticline lies chiefly in sec. 31, T. 25 N. Its outline as shown is based principally on elevations on a thin limestone lying about 20 to 25 feet below the Grayhorse limestone. It covers an area of about half a square mile and has well-defined dips to the north, south, and west. There is no east dip. The crest of the anticline probably lies about 1,200 feet northwest of the southeast corner of sec. 31, and the depth at that point to the "Oswego lime" and "Mississippi lime" is estimated to be about 2,300 and 2,900 feet, respectively.

North Hominy Creek anticline.—The North Hominy Creek anticline is the most pronounced fold in the area covered by this report. It occupies all of sec. 22 and parts of the surrounding sections in T. 24 N. Its contouring is based on elevations on the Bird Creek, *Cryptozoon*-bearing, and Stonebreaker limestones and other thin limestones lying between these key beds. The fold has an east closure of 10 to 15 feet. The dips to the north and south amount to about 30 feet in the first half mile, and that to the west is about 100 feet in the first mile. The fold has a large gathering ground from which oil and gas may have been obtained, and because of its nearness to productive oil and gas territory on the east it is considered the most favorable structure of the area here discussed. The highest point on the anticline is in the SW. ¼ NE. ¼ sec. 22, and at that place the "Oswego lime" is estimated to be at a depth of about 2,000 feet and the "Mississippi lime" at 2,500 to 2,600 feet below the surface.

South Hominy Creek anticline.—The South Hominy Creek anticline occupies secs. 25 and 36, T. 24 N., but the greater part of it extends eastward into the Pawhuska quadrangle. That part of the fold lying in the "western Osage" was outlined by elevations on the Bird Creek limestone, which shows north, south, and west dips. The anticline has a fairly good gathering ground and is regarded as affording good opportunity for the accumulation of oil and gas. The highest part of the fold and therefore the best place for a test well is probably about the center of the SE. ¼ sec. 25.

R. 6 E.

Upper Salt Creek dome.—The Upper Salt Creek dome occupies parts of secs. 3, 4, 5, 8, 9, and 10, T. 26 N., the northern part of it extending into the Foraker quadrangle. The outline of the fold as shown on the map is based chiefly on elevations on the Red Eagle limestone and beds in the upper part of the Foraker. It probably has a closure on the northeast of 10 to 20 feet. An east dip of 15 feet in about half a mile is shown in the SE. ¼ sec. 9; on the west the dip

amounts to 90 feet in the first mile. The dome has an extensive gathering ground, and structurally offers good possibilities for the accumulation of oil and gas. Its crest lies a little northwest of the center of sec. 9, and at that point the "Oswego lime" should be reached at about 2,600 feet and the "Mississippi lime" at 3,100 to 3,200 feet.

North Lostman anticline.—The North Lostman anticline is a southwestward-trending nose with a slight dip to the north and south but no dip to the east, extending diagonally across sec. 33 and into the southwest corner of sec. 32, T. 26 N. It is not recommended for drilling until other more favorable folds have been tested.

South Lostman anticline.—The South Lostman anticline occupies parts of secs. 3, 4, 5, 8, and 9, T. 25 N., and covers about 1½ square miles. Its outline was determined by elevations taken on beds of the Foraker limestone. Its crest has a low saddle about the middle. The anticline has an east closure of about 10 feet; the dip to the north and south is gentle; that to the west amounts to about 70 feet in the first mile. The highest points on the anticline lie about 1,200 feet northeast of the west quarter corner of sec. 3, and 1,500 feet northeast of the southeast corner of sec. 4. At these places the "Oswego lime" is estimated to be about 2,550 feet below the surface and the "Mississippi lime" 500 to 600 feet lower.

Solomon Creek anticline.—The Solomon Creek anticline is a very small fold in the N. ½ sec. 21, T. 25 N., covering less than a quarter of a square mile. The east dip is less than 10 feet, as determined by observations on beds of the Foraker limestone. The fold is too small to be of much importance and should not be drilled until the larger folds have been tested.

Deadman anticline.—The Deadman anticline is another small fold, about comparable in size to the Solomon Creek anticline, lying in the S. ½ sec. 33, T. 25 N. Elevations taken on beds in the Foraker limestone show that the east dip is about 8 feet and the north and south dips are very small. The fold is not recommended as favorable for a test well in this part of the "western Osage" before more promising fields are drilled.

Little Grayhorse anticline.—The Little Grayhorse anticline is a long, narrow fold extending from the NW. ¼ sec. 1 to the south side of sec. 10, T. 24 N. Its outline, determined from elevations taken on the Grayhorse limestone and the thin limestones below it, shows that it has gentle north, south, and west dips but no eastward dip except a very slight sag crossing the main axis at right angles in the north-central part of sec. 11. The fold has a good gathering ground on the north and west. From its highest point in the NW. ¼ sec. 11 the "Oswego lime" and "Mississippi lime" are estimated to lie at depth of 2,350 and 2,950 feet, respectively.

R.6 E.

R.7 E.

T. 26 N.

T. 25 N.

T. 24 N.

UPPER SALT CREEK DOME

LITTLE CHIEF TERRACE

UPPER LITTLE CHIEF DOME

LOWER LITTLE CHIEF DOME

NORTH LOSTMAN ANTICLINE

SOUTH LOSTMAN ANTICLINE

SOLOMON CREEK ANTICLINE

DEADMAN ANTICLINE

CLEAR CREEK ANTICLINE

UPPER GRAYHORSE ANTICLINE

LITTLE GRAYHORSE ANTICLINE

MIDDLE GRAYHORSE ANTICLINE

LOWER GRAYHORSE ANTICLINE

LOWER SALT CREEK ANTICLINE

RAINBOW ANTICLINE

FAIRFAX

Grayhorse

Salt Cr.

Salt Creek

Lostman Creek

Little Chief Creek

Clear Creek

Little Grayhorse Creek

Grayhorse Creek

Hominy Creek

No exposures

SANTA FE

ATCHISON TOPEKA AND

WEST SIDE OF PAWHUSKA QUADRANGLE

EXPLANATION

- Boundary of alluvium
- Base of Neva limestone
- Top of Red Eagle limestone
- Base of Foraker limestone
- Grayhorse limestone
- Top of Stonebreaker limestone
- Cryptozoon-bearing limestone
- Bird Creek limestone
- Structure contours
  Solid lines, error probably not more than 10 feet.
  Dashed lines, error may be more than 10 feet.
  Dotted lines, position inferred
  Contour interval 10 feet

MAP SHOWING GEOLOGIC STRUCTURE OF TPS. 24 AND 25 N., R. 6 E., AND PARTS OF T. 26 N., R. 6 E., AND TPS. 24, 25, AND 26 N., R. 7 E., OKLAHOMA

Scale 1/31,250

1 ½ 0 1 Mile

1918

Middle Grayhorse anticline.—The Middle Grayhorse anticline lies mainly in sec. 25, T. 24 N., but extends eastward into sec. 30, T. 24, N., R. 7 E. This fold, whose outline was determined by elevations on beds of the Stonebreaker limestone and the thin limestone above it, is in reality a broad, flat terrace with slight dips to the north and south and somewhat steeper dips on the west. Its upper surface is nearly level in an east-west direction. It is not recommended for drilling until other more favorable folds have been tested.

Lower Grayhorse anticline.—The Lower Grayhorse anticline is a very low, narrow fold about 1½ miles long lying mainly in secs. 35 and 36, T. 24 N. Its outline as mapped is based on elevations on the top of the Stonebreaker limestone and a thin limestone about 20 to 25 feet above it. There is a slight east dip at the extreme east end of the fold, in sec. 31, T. 24 N., R. 7 E. West of this point the axis has a very slight dip to the west for a mile and a half and steepens to about 40 feet in the next half mile. The dips to the north and south are not more than 15 feet. The fold is not of sufficient promise to warrant drilling until more favorable folds have been thoroughly tested. The most favorable localities for test wells are 1,000 feet south and 300 feet west from the northeast corner of sec. 36 and near the west quarter corner of the same section.

Lower Salt Creek anticline.—The Lower Salt Creek anticline is a low, narrow fold trending northwest across sec. 30, T. 24 N. Elevations on the Grayhorse limestone and the thin limestones above it disclose a southeast dip of about 10 feet extending for nearly half a mile southeastward from the center of sec. 30. The dips to the northeast, southwest, and west are low.

R. 5 E.

East Bluff Creek anticline.—The East Bluff Creek anticline is a broad, gentle fold lying mainly in the SW. ¼ sec. 17 and the SE. ¼ sec. 18, T. 26 N. Its outline was determined by elevations on the Crouse limestone which indicate an east dip of about 8 feet extending eastward for about a quarter of a mile from the center of the small area inclosed by the 280-foot contour. The dip to the north and south is gentle and amounts to not more than 20 feet. The anticline is therefore little more than a broad wrinkle, of insufficient promise to warrant drilling unless more pronounced folds are found to contain oil and gas.

Jim Creek anticline.—The Jim Creek anticline is a low, broad nose, very similar in form to the East Bluff Creek anticline, in secs. 31 and 32, T. 26 N. Its shape was determined by elevations taken on the Crouse limestone. The dip to the north and south amounts to about 20 feet in half a mile; it has no eastward dip.

R. 4 E.

West Bluff Creek dome.—The West Bluff Creek dome is a very gentle oblong upwarp whose outline was determined from elevations on the Crouse and Wreford limestones. It lies in secs. 13 and 24, T. 26 N., covers an area of nearly 1 square mile, and has a closure of one contour over about half that area. The eastward dip amounts to only about 8 feet, and the dips to the north, south, and west are gentle. The dome has a sufficiently large gathering ground on the west and southwest to afford an accumulation of oil or gas. The crest of the dome lies a few hundred feet northwest of the south quarter corner of sec. 13. The depth to the "Oswego lime" and "Mississippi lime" at this point is about 2,900 and 3,500 feet, respectively.

Schoolhouse anticline.—The Schoolhouse anticline is a westward-plunging nose, terminating on the east in a terrace and occupying most of sec. 27 and part of the north side of sec. 28 and the south side of sec. 21. The outline of the fold was determined by elevations on the Wreford limestone. The dip to the north is about 20 feet in the first half mile; that to the southwest averages 50 feet, and that to the west about 90 feet to the mile. The "Oswego lime" is estimated to lie at a depth of about 3,000 feet and the "Mississippi lime" at about 3,600 feet below the crest of the fold in the center of the NE. ¼ sec. 27, which would be the best locality for a test well. So far as structural conditions are concerned the fold affords good possibilities for the accumulation of oil and gas.

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